I. M. Okkes¹, A. Groen²,
S. K. Oskam¹, H. Lamberts¹

Advantages of Long Observation in Episode-oriented Electronic Patient Records in Family Practice

¹Department of Family Practice,
Division of Public Health, Academic
Medical Center, University of Amsterdam,
Amsterdam,

²Family Physician Transition Project,
Amstelveen, The Netherlands

Abstract: From 1985–2000, 58 Dutch family physicians (FPs) of the Transition Project collected ICPC-coded data on 47, 2451 episodes of care, first in paper records for direct encounters only, later with a complete electronic patient record (EPR) for all (direct and indirect) encounters. Based on these data, the effects of a long observation period and the inclusion of all encounters (both direct and indirect) in the EPR were studied. Long observation periods in EPRs appear to have important advantages for patient documentation and the assessment of the content of family practice. Comparison of data from a one-year versus a four-year observation period showed a shift in utilization rates. In a long observation period, visiting patients appeared to make less demand on care, while the content of the FP's care for selected chronic diseases was reflected more realistically. The inclusion of all indirect encounters in an EPR (as compared to the previous inclusion of direct encounters only) resulted in more than twice the number of coded entries per listed patient, and thus led to a major shift in perspective on the FP's involvement in patient care.

Keywords: EPR, Episode of Care, Family Practice, Observation Period, Utilization

1. Introduction

In 1995, little optimism existed with regard to a swift availability of a high-quality electronic patient record (EPR) in family practice: widespread EPR implementation was not expected to occur before 2001, and more likely by 2010 [2-5]. The main reason was considered the lack of *clinical pull*, as opposed to the then already strong *technical push*, which seemed to be out of phase with the clinical perspective on the utility of an EPR [3, 6-8]. This overall sentiment of guarded skepticism has largely disappeared, and been replaced by enthusiasm in anticipation of a para-

digm shift in patient documentation [9-12].

In the Netherlands, the majority of the 7,000 family physicians (FPs) now routinely use an EPR for their listed patients, although in most cases this EPR has not replaced the paper record entirely [13-15]. Within the next few years, a new generation of complete episode of care-oriented EPRs will become available, based on the use of the second edition of the International Classification of Primary Care (ICPC-2) [16-19]. The ICPC brings order in the domain of family practice on the basis of the most common symptoms, complaints, reasons for encounter, interventions, and episodes of care. It allows for the coding of patients' reasons for encounter, the diagnoses and diagnostic and therapeutic interventions for each encounter, in an episode of care structure [19-21]. Its prime goal is to support practice management and quality assurance, and to allow a reliable retrieval of patient data for epidemiological

purposes. The Dutch College of General Practitioners is providing a strong *clinical pull* towards the use of the ICPC in episodes of care-oriented patient documentation, by making this a requirement for an EPR to be authorized which, on its turn, is a requirement for the FP to receive a substantial financial compensation for making use of an EPR [16].

"Transhis" is a prototype of such a new EPR, in use since 1995 in the Transition Project of the Department of Family Practice of the Academic Medical Center of the University of Amsterdam (1985–2000). The main goal of the Transition Project is the analysis of the content of family practice in great clinical detail, for epidemiological purposes and to support quality assessment, health care policy, medical education and research, as is the case in other morbidity studies in several European countries and Australia [22-27]. Data collection consists of routine by recording and coding all episodes of care* in

The World Organization of Family Doctors (WONCA) has authorized a *Glossary* as the standard terminology to be used in reporting data from family practice [1]. In this article, terms are used in conformity with this *Glossary's* definitions; some terms (marked by an asterisk in the text) are defined in the *Appendix*.

listed populations, first with self-copying encounter forms in a paper record (1985–1994), and later with Transhis as a complete EPR (1995–2000) [22, 28]. Altogether, 58 FPs in 23 practices in the Netherlands coded all encounters with the ICPC: reasons for encounter*, diagnoses*, and interventions in an episode of care structure [18–22]. At any moment in time, the diagnostic label of an episode of care could be modified; from the moment that this occurred, the episode continued to exist, but carried a new, more appropriate diagnostic title. The *episode of care* served as the unit of assessment: “a health problem or a disease in an individual from the first encounter for it with a health care provider until the completion of the last encounter for it in the observation period” [20, 21, 28, 29]. The overall reliability in the paper record after central data entry and data cleaning was very high: approximately 2% of all episode titles were missing or coded erroneously [22, 30].

The shift, in 1995, from a paper record towards a complete EPR entailed more than a simple change from paper to computer; the paper record contained data on direct encounters* only, whereas in Transhis also all indirect encounters* were included [21]. Also, from then on, the ICPC (as a classification) was used together with ICD-10 (as a nomenclature with far more granularity), through a mutual mapping, in order to allow an adequate

documentation of rare diagnoses on the level of the individual patient [17, 18, 30, 31].

Because of the long observation period and the increased detail, we expected the data collected with Transhis to provide a new perspective on the participating FPs’ work. In this article, the following questions are addressed:

1. What is the influence of a long observation period on utilization rates* in family practice;
2. What is the influence of a long observation period on episode and intervention rates in family practice;
3. What is the influence of the inclusion in a complete EPR of all direct and indirect encounters with or concerning a patient, either by the FP or a secretary or nurse?

2. Methods

2.1 Databases

In this study, three databases were used (Table 1).

Database A: 54 FPs in 23 practices distributed over The Netherlands routinely collected and coded data for all face to face (direct) encounters with their listed patients. As is the case in all complete and time-consuming morbidity studies, the participating FPs were selected and highly motivated and, in

this respect, not representative for the average Dutch FP [22, 28, 32]. Each FP participated for at least one year; however, several of them collected data for longer periods, up to the complete registration period of ten years.

All new and rollover (or ongoing) episodes of care* were included in the registration year in which they were dealt with on least at one occasion in a direct encounter. An episode with a follow-up encounter* in a later registration year was included in that registration year as a rollover episode. When an episode of a chronic disease was coded in two (or more) registration years, it was included two (or more) times in the average one-year prevalence.* The average listed practice population on a yearly basis served as the denominator. Consequently, the annual prevalence rate* is based on the annual incidence rate* plus the ‘rollover’ of episodes of care* already existent before a registration year (the ‘rest-prevalence’*) that were dealt with again in the registration year. All prevalence and other rates in the reference database have been directly standardized for the Dutch population in 1995. Database A serves as a sex and age specific epidemiological reference database, and has been published on a CD-ROM, included in a textbook on family practice [22].

Database B (Table 1) is a subset of database A, containing data from 7 FPs who contributed to database A for many years. This allowed the construction of a four-year observation period, resulting in cumulative incidence rates, to which the episodes of care existent before the start of the four-year observation period were added (rest prevalence). For database B, each episode of care was counted only once in a time frame of 1,460 days; again, all rates were directly standardized for the Dutch population in 1995. Database B is not representative for database A, since data were used from three practices only.

Database C (Table 1) is in use since January 1st, 1995 and is based on the inclusion of database B in the EPR Transhis (approx. 9,400 patients). On January 1st, 1997, another 6,400 patients from three practices were added. Database C includes all direct and indirect encounters.

	A Reference database	B Four years database	C EPR database
Observation period	1985–1994	1989–1993	1995–1998
Documentation method	paper record	paper record	EPR
Mean registration period in years	1	4	2,7
Participating family physicians	54	7	10
Listed patients	50,261	9,405	18,703
Patient years	93,297	37,620	48,641
Episodes of care	236,027	78,950	136,424
Direct encounters	267,897	106,628	135,383
Indirect encounters	-	-	179,545
Interventions	617,806	232,608	476,554
Prescriptions	-	-	236,833

Table 1 Three databases from the Transition Project.

2.2 Setting

All Dutch citizens are insured for health care costs and, by law, their access to specialist care is limited by the gate keeping function of their FP, who effectively takes care of 'the large majority of personal health care needs of the population' [29]. This means that patients cannot seek specialist care without a referral by their FP, who is designated the sole primary care physician in the health care system, as opposed to other countries, such as the US, where also general internists, pediatricians and gynecologists, serve as primary care providers [29]. The Dutch system strictly regulates the choice and the quantity of prescribed drugs, which results in the need for FPs to issue many repeat prescriptions for refills.

The 16 million Dutch spend 8.7% of their GNP (2230 \$ per person per year) on health care [33]. Per 1,000 inhabitants, 2.7 practicing physicians are available, 0.45 of them FPs (average list size: 2,300). According to the OECD indicators, the Dutch population is relatively healthy, has a relatively long life expectancy, and makes sparse use of the available acute care hospital beds (3.8 per 1,000 inhabitants), with an average stay of nine days. Two thirds of the health care budget is spent on outpatient care: of the 5.4 ambulatory care encounters per patient per year, 3 are with an FP [33]. This average of 3 FP

visits for 2.5 episodes of care per year is very similar to the situation in the UK and several Scandinavian countries [23, 26]. In some other countries (e.g. Belgium, Poland and Japan), though the average of 2 or 3 episodes of care per patient per year in family practice is roughly similar, considerably more direct encounters occur [34-36].

2.3 Analysis

To answer *question 1*, standardized rates of direct encounters, new and rollover episodes of care were calculated for listed* and visiting patients* in the one- and the four-year observation period, together with incidences, prevalences, episode duration, and number of interventions per episode. The ICPC distinguishes 'symptom/complaint diagnoses' (e.g. headache, tiredness, nausea) from 'disease diagnoses' (e.g. hypertension, asthma, duodenal ulcer). Standardized rates were calculated separately for both diagnostic groups. The four-year prevalence rates consist of four consecutive one-year incidence rates plus the rest-prevalence of all ongoing (rollover) episodes of care. The differences were tested with Pearson's Chi square test, with a continuity correction for tests with one degree of freedom; this test was performed on the numerical data, and not on the percentages presented in the tables.

To answer *question 2*, data were analyzed for patients with one of fifteen

episodes of care, selected because they 1) can occur only once in an individual patient, and 2) because they were expected to reflect the influence of a long observation period relatively well.

To answer *question 3*, all direct and indirect encounters for listed patients were counted per episode, per listed patient per year and per patient included in the EPR.

3. Results

3.1 Question 1

The encounter rates per listed and per visiting patient in a one-year and a four-year observation period showed the influence of the substantial proportion of non-visiting patients in one year (28%), as compared to 8% in four years (Fig 1). The encounter rates strongly depended on age. In a four-year period, all rates per listed patient were practically four times the annual rate. The average difference in encounter rate of approx. 1 encounter between visiting and listed patients remained practically the same. As a consequence, encounter rates per visiting patient were not four times, but close to three times the annual rate, except in the very old, where the proportion of non-visiting patients in one year was relatively small.

A similar shift occurred in the episode rates (Fig. 2). The proportions of

Fig. 1 Direct encounters per listed patient/visiting patient by age group, in one year and four years (average).

Fig. 2 Episodes of care per listed patient/visiting patient by age group, in one year and four years (average).

new and rollover episodes of care shifted with time. Although the new episode rate per listed patient remained the same, the number of rollover episodes hardly increased, and its relative contribution was substantially smaller in four-years. Consequently, the four-year episode rate was considerably smaller than four times the annual rate, both for listed and for visiting patients.

Visiting patients appeared to make a quantitatively healthier impression in a four-year period since the average utilization of FP care is smaller. This effect was stronger for the adult population (15-65 years) than for the very young and the very old: the health status of visiting adults (15-65 years) was, therefore, described more realistically in a longer observation period.

Table 2 illustrates the effect of a four-year as compared to a one-year observation period on the description of episodes of care, both with a symptom diagnosis and a disease diagnosis. The longer observation period resulted in a longer duration of episodes of care: the proportion extending over more than 26 weeks tripled for both episode types. The proportion of episodes

Table 2 Episode duration for new episodes, and number of encounters and interventions for new and ongoing episodes (symptom and disease diagnoses) in a one- and a four-year observation period (percentages). Chi square test: xxx = $p < 0.0001$; xx = $p < 0.001$; x = $p < 0.01$; ns = $p \geq 0.01$.

	New episodes						Ongoing episodes					
	Symptom diagnoses			Disease diagnoses			Symptom diagnoses			Disease diagnoses		
	1 yr n=72257	4 yrs n=28223	χ^2	1 yr n=113695	4 yrs n=43839	χ^2	1 yr n=14910	4 yrs n=1894	χ^2	1 yr n=34268	4 yrs n=4695	χ^2
Duration of episode												
<4 weeks	91.8	88.3	xxx	89.7	85.7	xxx						
4-26 weeks	7.0	7.6		8.5	8.4							
>26 weeks	1.2	4.1		1.8	5.8							
Encounters per episode												
1	81.2	76.7	xxx	75.7	71.2	xxx	71.2	58.8	xxx	54.3	44.7	xxx
2	12.8	14.6		14.4	15.2		17.6	20.4		18.0	16.9	
3	3.6	4.7		4.9	5.8		5.9	8.1		9.8	9.0	
4 and >4	2.4	4.0		4.9	7.8		5.3	12.7		17.9	29.5	
Interventions												
Physical exam	70.4	76.7	xxx	84.5	86.8	xxx	44.5	49.9	xxx	66.8	72.6	xxx
Blood test	6.9	8.0	xxx	5.1	6.6	xxx	3.6	4.4	ns	8.9	11.4	xxx
Imaging	3.5	4.3	xxx	3.9	4.7	xxx	2.4	3.4	ns	2.7	4.0	xxx
Medication	31.5	30.4	xx	48.0	45.3	xxx	45.1	51.8	xxx	51.0	52.9	ns
Referral to specialist	5.4	6.2	xxx	8.2	9.0	xxx	6.6	7.8	ns	10.4	15.5	xxx

Table 3 Selected episodes of care: one-year incidence, one- and four-year prevalence rates per 10,000 listed patients (standardized for the 1995 Dutch population), percentage of episodes with a duration of > 26 weeks, with medication, additional testing and referral to a specialist in a one- and a four-year observation period. Chi square (χ^2) test: xxx: $p < 0.0001$; xx: $p < 0.001$; x: $p < 0.01$; ns: $p \geq 0.01$.

Diagnoses	Incidence rate	Prevalence rate		Percentage of episodes with a duration > 26 weeks			Percentage of episodes with medication			Percentage of episodes with labtest/ imaging			Percentage of episodes with a referral		
	1 yr	1 yr	4 yrs	1 yr	4 yrs	χ^2	1 yr	4 yrs	χ^2	1 yr	4 yrs	χ^2	1 yr	4 yrs	χ^2
Duodenal ulcer	14	28	84	30	33	ns	79	88	ns	26	36	ns	11	14	ns
Uncomplicated hypertension	66	501	613	70	86	xxx	73	80	xxx	6	15	xxx	1	3	xx
Heart failure	42	80	200	33	37	ns	78	82	ns	15	23	xxx	15	19	ns
Stroke	21	40	101	31	36	ns	37	38	ns	7	13	ns	29	39	ns
Asthma	63	146	416	36	48	xxx	86	88	ns	7	9	ns	7	7	ns
Chron. Bronchitis / COPD	27	102	235	49	58	x	79	81	ns	10	18	xx	9	15	x
Psoriasis	11	29	102	33	56	xxx	71	75	ns	1	1	ns	22	29	ns
Diabetes mellitus	26	150	272	65	79	xxx	53	63	xx	74	86	xxx	8	17	xxx
Epilepsy	7	23	59	46	62	ns	44	40	ns	6	13	ns	32	40	ns
Migraine	33	73	200	30	46	xxx	74	73	ns	3	3	ns	5	8	ns
Osteoarthritis	117	207	550	27	35	xxx	48	47	ns	26	34	xxx	10	13	ns
Depressive disorder	64	128	395	35	42	x	61	70	xx	8	11	ns	14	17	ns
Uterovaginal prolapse (women)	21	44	117	41	40	ns	55*	52*	ns	-	1	ns	19	29	ns
Benign prostatic hypertrophy (men)	18	26	91	18	26	ns	13	8	ns	19	38	xxx	33	42	ns
All malignancies	64	121	322	24	37	xxx	26	29	ns	13	30	xxx	34	50	xxx

* Treatment with a pessary is included in 'medication'

lasting less than four weeks remained very high, because well over 70% were one-encounter episodes, which is characteristic for family practice [22, 23, 26]. The proportion of new episodes of care with three or more face-to-face encounters increased over time, especially in 'disease' episodes. Although we do not know the utilization for rollover episodes before the observation period, it is evident that the proportion of rollover 'disease' episodes with three or more encounters was high (29.5%). This relatively small group of presumably chronic episodes of care should not be excluded from the analysis of the content of family practice.

The influence of a four-year observation period on the rates of selected interventions per episode type is, from a practical clinical perspective, rather limited. The proportion of new episodes in which medication was prescribed was slightly smaller in the four-year observation period, and probably due to a change in the reimbursement of drug costs to patients at that time, with a shift towards 'over the counter' drugs. The higher proportion of referrals to a specialist in rollover episodes with a disease diagnosis, is important from a practical perspective.

3.2 Question 2

Table 3 presents data for 15 selected diseases (or disease groups). As could be expected, all prevalence rates were considerably higher in a four-year than in a one-year observation period. The

more chronic the course over time of a disease, the smaller the one-year incidence as compared to the one- and four-year prevalence (e.g. hypertension, diabetes). All diseases listed in Table 3 could only occur once in an individual patient, as opposed to diseases that allow multiple episodes e.g. acute bronchitis; these rates seem to represent the distribution of morbidity in a population more realistically when observed in a four-year period.

The proportion of episodes of care lasting more than six months was substantially larger in four years for hypertension, asthma, psoriasis, diabetes, and malignancies. The proportion of episodes with medication increased for hypertension, diabetes and depressive disorder. The use of additional tests increased over time for several conditions, as did the proportion of episodes with a referral to a specialist. On the other hand, the characterization of episodes such as duodenal ulcer, heart failure, epilepsy, prolapse, and prostatic

hypertrophy were hardly influenced by a longer observation period.

3.3 Question 3

In Table 4, all episodes, all direct and indirect encounters are presented per listed patient per year, and per listed person (average observation period 2.7 years) are presented (see also Fig. 2). The number of indirect encounters surpassed that of direct encounters. The contribution of prescriptions to patient documentation was substantial. Repeat prescriptions or refills constituted more than half of all prescriptions. The sum of all telephone and administrative encounters, referrals, and additional tests resulting in additional data entry was close to the total of all face-to-face encounters. Complete EPRs routinely used over the years for all encounters with or on behalf of patients present a very different perspective on the content of family practice than does a system based on direct encoun-

Table 4 All direct and indirect encounters, episodes and interventions per episode, per listed person per year and per person included in the EPR (Transhis).

	per episode	per listed person per year	Per person listed in Transhis
All episodes (n=136,424)	-	2.80	7.29
Ongoing episodes (n=14,745)	-	0.30	0.79
All encounters (n=314,928)	2.30	6.64	16.82
Direct encounters (n=135,383)	0.99	2.78	7.23
Telephone contacts (n=13,222)	0.10	0.27	0.71
Prescriptions without direct encounter (n=120,944)	0.88	2.48	6.46
Administration without direct encounter (n=45,379)	0.33	0.93	2.43
All interventions (n=476,554)	3.48	9.77	24.5
Prescriptions (n=236,833)	1.73	4.86	12.65
Referrals (n=19,098)	0.14	0.39	1.02
Lab test/imaging (n=31,619)	0.23	0.65	1.69

ters only. The average of well over 25 interventions documented per person included in the EPR adds an important new dimension to the average number of seven face-to-face encounters in the same period.

4. Discussion

A long observation period provides a more realistic perspective on the content of care provided by the FP. Some differences, however, have only limited clinical importance. Quite important is the overall shift in utilization rates per listed and per visiting patient [37]. It is evident that rollover (ongoing) episodes of care have to be included in the analysis of the content of family practice. In a four-year observation period, the representation of the utilization per listed and per visiting patient shifts: the decrease in average encounter rates compensates for listed patients who do not consult in one year but do so in a four-year period. The average encounter and new episode rates per listed patient are constant. The influence of ongoing episodes of care on yearly episode rates decreases considerably in a four-year period: both listed and visiting patients appear to be 'healthier' than is the case in the usual, but rather artificial one-year time window.

In four years the utilization rates per episode do increase, especially for 'disease' episodes, but the overall effect of a longer observation period is of limited clinical importance. For many new episodes of care, a longer observation period hardly adds information, since they often consist of one encounter only. The overall differences in intervention rates between symptom diagnoses and episodes with a 'disease' label are much more important: regardless of the length of the observation period, the active involvement of FP's with 'diseases' is considerably larger than is the case in symptom diagnoses. The role of the FP in rollover episodes is quite different in a long observation period: the proportion of ongoing 'disease' episodes receiving care from the FP over a longer period of time is considerably higher than in new episodes of care. Apparently a hard

core exists of patients with episodes of chronic diseases that require ongoing medical attention, which is underestimated in one-year data.

The comparison of the rates for the fifteen selected diseases illustrates that disease-specific interpretations are needed to optimally characterize the contribution of the FP to each of them. The cumulative four-year prevalence rates give a more realistic perspective on the occurrence of selected diseases in a population where continuity of care is the rule. Data on the FP's contribution to care for duodenal ulcer, heart failure, stroke, epilepsy, uterovaginal prolapse, and prostatic hypertrophy hardly change in long-term data. However, FP care for chronic diseases such as hypertension, diabetes, arthritis, and malignancies is better described with long-term data since medication, additional testing and referrals are not sufficiently captured in a one-year period [38, 39].

The inclusion of all indirect encounters in an EPR makes a substantial difference. Both from a clinical and a legal perspective, all interventions by a FP or a medical secretary have to be documented, and explicitly related to episodes of care. Practice management develops into a preponderance of indirect encounters, and this is expected to increase with electronic communication on behalf of or directly with the patient.

The long observation period in an EPR influences our perspective of care given by family doctors. The major advantage of longer observation periods, however, will be the different approach which is only possible with sophisticated EPRs. The clinical pull in this direction is now supported by more data, and thus may balance the technical push.

Appendix: List of Terms

Diagnosis: The formal statement of the provider's understanding of a health problem presented by a patient. It may be a symptom diagnosis, which is limited to the level of symptoms, or a disease diagnosis. The term represents the formal medical establishment of an episode of care.

Encounter: Any professional interchange between a patient and one or

more members of a health care team. One or more episodes of care may be dealt with at an encounter.

1. *Direct encounter:* An encounter in which a face-to-face contact between patient and professional occurs.
2. *Indirect encounter:* An encounter without face-to-face contact between patient and health care professional (e.g. telephone call, letter, repeat prescription, or through a third party).
3. *Follow-up encounter:* An encounter in which an episode of care previously initiated is continued.

Episode of care: The period from the first presentation of a health problem to a health care provider until the completion of the last encounter for that health problem (within an observation period).

1. *New episode of care:* an episode that starts in the observation period
2. *Rollover (or ongoing) episode of care:* an episode that has been started before the observation period, and is dealt with again during the observation period

Incidence: The number of new instances of a health problem, during a defined period in a specified population (usually per 1,000 persons per year).

Patient, listed: A person who receives or contracts for medical advice or services from a health care provider with whom he/she is registered.

Patient, visiting: A listed patient who has at least one encounter during an observation period.

Prevalence: The total number of all health problems or of all persons with a health problem in a specified population during a defined period of time (usually expressed per 1,000 persons per year, per 4 years or per lifetime).

Rates: The number of events or conditions occurring in a specified population in a defined period of time (nominator), divided by the total number of patients in the population (denominator). A population may contain all listed patients or all visiting patients.

Reason for encounter: The agreed statement of the reason(s) why a person enters the health care system, representing the demand for care by that person.

Rest prevalence: the number of rollover episodes of care with at least one encounter in the observation period.

REFERENCES

- Bentzen N. An international glossary for general/family practice. *Fam Pract* 1995; 12: 341-69.
- Van der Lei J, Beckers WPA, eds. *Strategic Alliances between Patient Documentation and Medical Informatics*. Proceedings AMICE 95. Rotterdam: VMBI/TMI Office 1995.
- Lamberts H, Hofmans-Okkes I. The generic patient record: an alliance between patient documentation and medical informatics [editorial]. *Method Inform Med* 1996; 35: 5-7.
- Van Bommel JH, McCray AT, eds. *IMIA Yearbook of Medical Informatics 1995: the Computer Based Patient Record*. Stuttgart, New York: Schattauer 1995.
- De Maeseneer J, Beolchi L, eds. *Telematics in Primary Care in Europe*. Studies in Health Technology and Informatics (volume 20). Amsterdam: IOS Press 1995.
- Pringle M, Ward P, Chilvers C. Assessment of the completeness and accuracy of computer medical records in four practices committed to recording data on computer. *Br J Gen Pract* 1995; 45: 537-41.
- Sullivan F, Mitchell E. Has general practitioner computing made a difference to patient care? A systematic review of published reports. *Br Med J* 1995; 311: 848-52.
- Tange HJ. The paper-based patient record: is it really so bad? *Comp Meth Progr Biomed* 1995; 48: 127-31.
- McDonald CJ. The barriers to electronic medical record systems and how to overcome them. *JAMIA* 1997; 4: 213-21.
- Van der Lei J, Moorman PW, Musen MA. Electronic patient records in medical practice: a multidisciplinary endeavor. *Method Inform Med* 1999; 38: 287-8.
- Lenhart JG, Honess K, Covington D, Johnson KE. An analysis of trends, perceptions, and use patterns of electronic medical records among US family practice residency programs. *Fam Med* 2000; 32: 109-14.
- Ornstein S. Electronic medical records in family practice: the time is now. *J Fam Pract* 1997; 44: 45-8.
- Van der Lei J, Duisterhout JS, Westerhof H, et al. The introduction of computer-based patient records in the Netherlands. *Ann Int Med* 1993; 119: 1036-41.
- Knottnerus A. The role of the electronic patient record in the development of general practice in the Netherlands. *Method Inform Med* 1999; 38: 350-4.
- Vlug AE, Van der Lei J, Mosseveld BMTH, et al. Postmarketing surveillance based on electronic patient records: the IPCI project. *Method Inform Med* 1999; 38: 339-44.
- Van Damme RAE, ed. *Toelichting WCIA-HIS Referentiemodel 1995* (status op 1 november 1999). Utrecht: Nederlands Huisartsen Genootschap, 1999.
- ICPC-2. *International Classification of Primary Care*. Second edition. Oxford: Oxford University Press 1998.
- Okkes IM, Jamoulle M, Lamberts H, Bentzen N. ICPC-2-E. The electronic version of ICPC-2. Differences with the printed version and the consequences. *Fam Pract* 2000; 7: 101-6.
- Lamberts H, Wood M, eds. *ICPC. International Classification of Primary Care*. Oxford: Oxford University Press 1987.
- Lamberts H, Hofmans-Okkes I. Episode of care. A core concept in family practice. *J Fam Pract* 1996; 42: 161-7.
- Iggulden P. Towards an 'Episode of Care' approach: A Project Briefing. Winchester: NHS 2000.
- Okkes IM, Oskam SK, Lamberts H. Van Klacht naar Diagnose. *Episodegegevens uit de Huisartspraktijk*. Bussum: Coutinho 1998.
- McCormick A, Fleming D, Charlton J. *Morbidity Statistics from General Practice*. Fourth National Study 1991-1992. London: HMSO 1995.
- The European Study of Referrals from Primary to Secondary Care. Report to the Concerted Action Committee of Health Services Research for the European Community. Occasional paper 56. London: R Coll Gen Pract 1992.
- Lamberts H, Wood M, Hofmans-Okkes I, eds. *The International Classification of Primary Care in the European Community*. With a Multilanguage Layer. Oxford: Oxford University Press 1993.
- Health Statistics in the Nordic Countries. Copenhagen: NOMESCO 1998.
- Bridges-Webb C, Britt H, Miles DA, et al. Morbidity and treatment in general practice in Australia. *Med J Aust* 1992; 157: Suppl 19 Oct: S1-S56.
- Veltman M. *Huisartsgeneeskundige zorgepisoden. Analyse van een zevenjaarsbestand* [Thesis University of Amsterdam]. Lelystad: Meditekst 1995.
- Donaldson MS, Yordy KD, Lohr KN, Vanselow NA, eds. *Primary Care: America's Health in a New Era*. Washington, DC: National Academy Press 1996.
- Meijer JS. *Zicht op ziekte. De classificatie van ziekten en gezondheidsproblemen in de huisartsgeneeskunde* [Thesis University of Amsterdam]. Amsterdam: Thesis 1998.
- ICD-10. *International Statistical Classification of Diseases and related Health Problems*. Tenth Revision. Vol. 1. Geneva: WHO 1992.
- Van Boven C, Dijksterhuis PH, Lamberts H. Defensive testing in Dutch family practice. Is the grass greener on the other side of the ocean? *J Fam Pract* 1997; 44: 468-72.
- OECD Health Data 99. *A Comparative Analysis of 29 Countries*. Paris: OECD Health Policy Unit 2000 (CD-ROM).
- De Maeseneer J, De Prins L, Heyerick JP. Home visits in Belgium: a multivariate analysis. *Eur J Gen Pract* 1999; 5: 11-4.
- Tsuda T, Aoyama H, Froom J. Primary health care in Japan and the United States. *Soc Sci Med* 1994; 38: 489-95.
- Lamberts H. Episodes of care in Japan, Poland, and the Netherlands. Paper presented at the 27th annual meeting of NAPCRG, San Diego 1999.
- Schlaud M, Brenner MH, Hoopmann M, Schwartz FW. Approaches to the denominator in practice-based epidemiology: a critical overview. *J Epidemiol Community Health* 1998; 52 (Suppl 1): 13S-19S.
- Morris AD, Boyle DIR, MacAlpine R, et al., for the DARTS/MEMO Collaboration. The diabetes audit and research in Tayside Scotland (DARTS) study: electronic record linkage to create a diabetes register. *Br Med J* 1997; 315: 524-8.
- Branger PJ, Van't Hooft A, Van der Wouden JC, et al. Shared care for diabetes. Supporting communication between primary and secondary care. *Int J Med Inf* 1999; 53: 133-42.

Address of the authors:
Ms. I. M. Okkes, PhD,
Academic Medical Centre,
University of Amsterdam,
Division-Public Health,
Department of Family Practice,
Meibergdreef 15,
1105 AZ Amsterdam,
The Netherlands
E-mail: i.m.okkes@amc.uva.nl